# Understanding Indoor Environments

Students will participate in an information gathering activity to learn about how various indoor environmental conditions affect physical and mental health. They will also learn how to code an accelerometer to create a step-counter as a way of understanding the role that sensors play on the ISS.

**Suggested Timing:** Science 30 - 40 min. plus research time, Coding 30 - 50 min.

## Success Criteria:

*Students will:*

- Use online sources to gather information
- Create a visual organizer to classify and analyze information
- Learn how environmental factors affect physical and mental health
- Learn about the positive mental and physical health benefits of exercise
- Code a basic program for a sensor (accelerometer) in a block-based coding language

## Student Prior Skills and Knowledge:

- Experience finding key information from a non-fiction resource
- Experience using digital resources for information-gathering
- Experience with the basic setup of the MakeCode environment and with uploading files to the micro:bit.

## Computational Thinking

### Concepts:

- Inputs (shake, button)
- Outputs (strings, integers)
- Sequences
- Events
- Repetition (Loops)
- Variables (declare, update)

### Practices:

- Algorithmic thinking
- Pattern recognition
- Decomposition
- Abstraction

### Approaches:

- Tinkering
- Reusing & Remixing

## Materials:

All of the activities in this lesson can be done online and submitted digitally.

- ❑ **BLM M2:** Understanding Indoor Environments Assignment [.doc] [.pdf] [fillable .pdf] - 1 per student or small group
- ❑ **Environmental Conditions on Earth and Onboard the International Space Station** Backgrounders on CurioCity (See the **Background Information** section)
- ❑ **Minds-On 2 Guided Materials** [.pdf]
- ❑ **BLM M2: Educator Answer Page** [.pdf]
- ❑ micro:bits (with USB cords) - 1 per 2-3 students

- ❑ Computers – PCs, chromebooks, laptops, etc. On iPads and tablets the micro:bit app may need to be installed
- ❑ Access to internet and MakeCode website (https://makecode.microbit.org/)
- ❑ Materials for wearable 'band' (optional)

### Preparation:

- ❑ If not using the online resources, BLMs will need to be printed.
- ❑ Students will need access to the internet to complete the assignment in Part M2.1. Background information is available in the Student Module.
- ❑ Set up equipment to show a video (if showing during class time).
- ❑ Sign out computer lab, laptops, chromebooks, etc., ideally one per 2-3 students.
- ❑ For Part M2.3, have micro:bits and Minds-On 2 Guided Materials ready (either on paper or digitally).

### Implementation Options:

- In addition to the background information provided, students could be encouraged to look for additional information on the internet.
- Instead of, or in addition to, having a class discussion, students could write short paragraphs for each factor which incorporate information from the chart.

## Minds-On 2.1: Learning about Indoor Environments

| Educators | Students |
|---|---|
| **Step 1** Provide students with **BLM M2** on paper or have them go to Minds-On 2.1 of the Student Module and review the assignment. In this research activity, students will be locating information and completing a graphic organizer (chart) about various indoor environmental conditions. | Read over **BLM M2** on paper or online. If anything is not clear, ask your teacher. |
| **Step 2** Students can use a paper version of the chart on page 2 of BLM M2 or use the fillable PDF [.pdf] in Step 2 of Minds-On 2.1 in the Student Module. They could also choose their own style of graphic organizer to help them to organize and classify information. Provide time for students to do research and complete the chart during class time, or assign as work to complete outside of class. | |

With younger students, ELL students, etc., you may wish to assign small groups of students to read and complete the assignment for only a single environmental condition (rather than for all of them).

**Step 3**

Once students have completed their charts, take up responses as a class. The **BLM M2 Answer page** outlines appropriate responses. Using a show of hands, or other method, have students indicate what they choose as the most important factor and explain their choice.

Rank the importance of the environmental factors for health and well-being from 1 (most important) to 5 (least important).

## Minds-On 2.2: Running in Space

### Educators

**Step 1**

Begin a class discussion about keeping healthy on Earth. Responses should include things like eating nutritious foods, exercising, not smoking, etc.

Next have students compare and contrast this to being healthy in space. Students should identify that the same things are important for astronauts.

**Step 2**

Show the video **Running in Space** or have students watch the video in the Student Module. In their own words, have the students describe **how** and **why** astronauts use the treadmill on the ISS. Using prompting questions such as:

- *How are the astronauts able to not float when running?*
- *What does the laptop by the treadmill monitor?*
- *What is the word for the force that the astronaut applies to the treadmill? (The load.)*

### Students

Answer the questions:

- *What things do people do to be healthy on Earth?*
- *What things do astronauts do to be healthy on board the ISS?*
- *How do you think astronauts exercise in space?*

Explain how and why astronauts use the treadmill. Be sure to describe how the treadmill works as well as what monitoring equipment is used.

**Did you know?**

On long duration missions, astronauts aboard the ISS must exercise approximately 2 hours a day!

Students should describe how the astronauts are secured in place using stretchy cords, how the treadmill measures the force exerted by the astronaut (the load) and that the astronaut's activity is monitored using a heart rate monitor.

## Minds-On 2.3: Coding a Step Counter

### Educators

**Step 1**

Have students share their ideas about how treadmills and step counters work.

- Sensors on the treadmill sense the force of each impact. This is recorded as a "step." The distance between "steps" on the treadmill can be measured.

Explain to the students that in the next micro:bit activity, they will be using a sensor called an accelerometer. Have students answer the accelerometer questions either individually, in small groups or as a class.

- An accelerometer measures acceleration.
- Acceleration is a change in velocity with respect to time.
- Accelerometers can be found on devices such as smart phones and step counters.
- Devices that detect or sense changes in the environment are called sensors.

**Step 2**

Have each small group of students (2-3) turn on and log into a computer/laptop/chromebook/iPad/tablet and navigate to https://MakeCode.microbit.org/ or open the micro:bit app.

### Students

Answer the questions (either in class, or online in Minds-On 2.3, Step 1 of the Student Module).

- *How would an astronaut know how far he/she had run on the treadmill?*
- *How do people on Earth know how far they walk/run?*
- *What do you think an accelerometer measures?*
- *What does acceleration mean?*
- *In what devices might you find an accelerometer?*
- *What do we call devices that sense changes in the environment?*

Turn on your device and log in. Navigate to https://MakeCode.microbit.org/ or open the micro:bit app.

**Step 3**

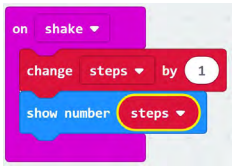
Show the **Minds-On 2 Guided Materials** on screen or have students follow the instructions or video walkthough in the Student Module.

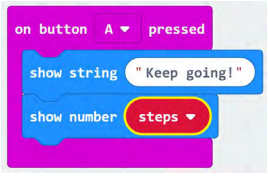
The completed code for this task should look something like this:

**Step 4**

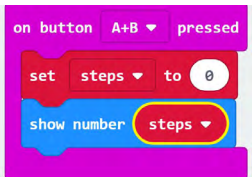
Students should save and upload their programs to their micro:bits. If they need a reminder as to how to do this, they should go back to Step 3 of the Minds-On 1.3 Student Module.

If students are done quickly, they can do the additional coding challenges provided in the Challenges section of the Minds-On 2 Student Module.








## Minds-On 2.4: Extensions

### Design & Technology

**Wearable Technologies Jigsaw**

- One way to extend student learning related to the step-counter is to have students research wearable technologies. Using a Jigsaw learning strategy, pairs or small groups of students can research a specific wearable technology used on Earth or in Space. Each group should create ONE PowerPoint or Google slide for a piece of wearable technology of their choice. Each slide should include:
  - ❑ An image of the technology being worn
  - ❑ The purpose of the technology
  - ❑ The type of sensors used (exact or what students think the sensors might be)
  - ❑ How the technology could be used in Space (if not designed for space already)

**Wearable Technologies 4-minute Design Challenge**

- In this quick activity, students will design a piece of wearable technology for an astronaut. Provide each student with a piece of paper and have them fold their papers into quarters. Students will have one minute per square to complete the information for their design.
  - ❑ What will it measure?
  - ❑ Where will it be worn?
  - ❑ What would it look like?
  - ❑ How would it help astronauts?

  Students could go a gallery walk to share their designs.

**Wearable Technologies Design & Build Project**

- Have students turn their micro:bits into portable step-counters. For this they would need to use the micro:bit battery pack as well as additional material such as washi or duct tape, Velcro, string, etc. Students can follow a Design & Build process to create their wearables.

## Environmental Science

- Students can investigate the **sources** (things that produce) and **sinks** (things that remove) carbon dioxide from the environment. You may choose to have them focus on a specific location, such as your school and school yard.

## Space Science

- Students can identify the systems onboard the ISS that are responsible for maintaining oxygen, carbon dioxide and water levels.

## Health & Physical Education

- If students create wearable step-counters, they could use them during physical activity time to assess their durability and comfort.
- If students create wearable step-counters, they could use they could predict the number of steps before doing a physical activity and then check their results when done. How close were their predictions?

# Minds-On 2.5: Additional Resources

## Background Information

- Why a Trip to Mars Could be Bad for your Bones (CurioCity Article)
- Temperature on Earth and on the ISS (CurioCity Backgrounder)
- Humidity on Earth and on the ISS (CurioCity Backgrounder)
- Carbon Dioxide on Earth and on the ISS (CurioCity Backgrounder)
- Light on Earth and on the ISS (CurioCity Backgrounder) (to come)
- Sound on Earth and on the ISS (CurioCity Backgrounder) (to come)

## Online Resources

- www.nasa.gov/audience/foreducators/topnav/materials/listbytype/Water_Filtration_Challenge.html (Accessed March 22, 2019)
  This activity from NASA, has excellent background information about the Environmental Control and Life Support System on the ISS and includes a Design & Build activity about water filtration.

- http://microbit-challenges.readthedocs.io/en/latest/tutorials/accelerometer.html (Accessed March 22, 2019)
  This page on the micro:bit MicroPython website, explains how the accelerometer works and provides additional ideas for using the accelerometer.

- http://www.asc-csa.gc.ca/eng/astronauts/living-in-space/physical-activity-in-space.asp (Accessed March 22, 2019)
  This page, on the Canadian Space Agency website, has information about the importance of physical activity in space. It includes a number of videos of Canadian astronaut Robert Thirsk using the exercise equipment on the ISS.

- https://www.nasa.gov/audience/foreducators/stem-on-station/ditl_exercising (Accessed March 22, 2019)
  This page on the NASA website has links to a number of exercising in space resources such as background information, activities and videos.

- https://learn.sparkfun.com/tutorials/accelerometer-basics (Accessed March 22, 2019)
  This page, from sparkfun, explains how an accelerometer works.


Chris Hadfield gets a CT scan of the bones in his ankle after returning to Earth in 2013 (Source: Canadian Space Agency)

**Did you know?**

Spaceflight osteopenia is the condition that causes astronauts to lose more than 1% of their bone mass for every month they spend in space.